# PENGARUH TINGKAT PEMOTONGAN TERHADAP PRODUKSI LAHAN KERING RUMPUT GAJAH TAHUN PERTAMA SETELAH PENANAMAN

# THE EFFECT OF CUTTING INTERVAL ON DRY MATTER YIELD OF NAPIERGRASS AT FIRST YEAR AFTER ESTABLISHMENT

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## ABSTRAK

Pengaruh tingkat pemotongan terhadap produksi bahan kering rumput gajah pada tahun pertama setelah ditanam guna menguji kelayakan tingkat pemotongan terhadap produktifitas dan tanaman tahunan. Tingkat pemotongan adalah 60 hari dan 90 hari dan tinggi pemotongan adalah 30 cm dari permukaan tanah. Produksi bahan kering tahunan tertinggi diperoleh pada tingkat pemotongan 90 hari. Persentase bahan kering terhadap bahan segar tidak berhubungan dengan produksi bahan kering tahunan. Tingkat pemotongan 90 hari memperoleh produksi tertinggi pada rataan berat anakan, ratio pertumbuhan tanaman, ratio assimilasi bersih dan produksi bahan kering, tetapi jumlah anakan dan persentase daun dan batang terendah terhadap seluruh hasil panen. Koefisien korelasi antara produksi bahan kering dengan karakteristik rumput adalah positif untuk tinggi rumput, rataan berat anakan, indeks luas daun dan ratio pertumbuhan rumput.

***Kata kunci: Produksi Bahan Kering, Rumput Gajah, Tingkat Pemotongan***

## ABSTRACT

The effects of cutting interval on dry matter productivity on napiergrass in the established year to examine the suitable cutting practice for the productivity and perenniality. The cutting intervals were 60 and 90 days, and the cutting heights were 30 cm above the ground. Annual herbage dry matter yield (HDMY) was the highest in the plants at a 90-day interval. The percentage of dry matter to fresh matter did not correlate with the annual HDMY. The plants cut at a 90-day interval had the highest in mean tiller weight, crop growth rate, net assimilation rate and HDMY, but the lowest tiller number and percentage leaf blade to the whole harvested plant. Thus, the correlation coefficients between HDMY and plant characters were positive for plant height, mean tiller weight, leaf area index and crop growth rate.

***Key Word: Herbage Dry Matter Yield, Napiergrass, Cutting Interval.***

## INTRODUCTION

Napiergrass *(Pennisetum purpureum*), are widely grown in tropical and subtropical regions for forage as well as for grain (Vicente-Chandler *et al*., 1959; Muldoon and Pearson, 1979; Mendoza and Schank, 1987; Ito and Inanaga, 1988; Woodard and Prine, 1993; Sunusi *et al*., 1999; Wadi *et al*., 2003).

Napiergrass was precisely examined for the wide profitability at several sites in western Japan. However, since the stem of napiergrass is easily hardened after elongation, the plants for forage should be cut at intervals before stem elongation (Sunusi *et al*., 1997). This growth characteristic obstructs the popularization of napiergrass among farmers. Thus, in the normal napiergrass, the appropriate cutting interval was determined to be 2 months on a quality basis, and 3 months on a yield basis (Sunusi *et al*., 1997). Usually, the farmers cut plants at 30 cm above the ground level, when the stem is elongated.

This study aimed to examine the suitable cutting interval for obtaining high herbage dry matter yield (HDMY) in napiergrass at the established year.

## MATERIALS AND METHODS

### 1. Grass species, plant establishment and managements

Grass species examined were napiergrass (*Pennisetum purpureum*, cv. Wruk wona) that is a promising high yielding napiergrass variety (Sunusi *et al*., 1999), at the first established year in 2001.

Rooted tillers of napiergrass were transplanted at 50 cm × 50 cm spacing (4 plant/$m^2$) on May 5, 2001. The plants were divided into two groups, and cut at 60-day and 90-day intervals (main plots), and each group was subdivided into two groups (subplot) and cut at 30 cm from ground level. The area of each subplot was 2.5 m × 2.5 m.

Subplots were set in a Latin square method with three replications. As a basal fertilizer, manure at 6 ton/ha and lime at 4 ton/ha were applied 2 weeks before planting. Top dressing of 300 kg N/ha/year was applied equally by split-application 6 times from May to October in 2001.

**2. Measurements of plant growth characters**

Fresh matter weight of harvested plants was recorded for 9 plants, and dry matter weight and some plant characters such as plant height, tiller number and leaf area were measured for 3 plants from each subplot at each sampling time. Harvested plants were divided into leaf blade, stem with leaf sheath and dead part, and dried at 70 °C for more than 3 days to determine dry matter weight. Fresh and dry matter yields were the product of fresh matter weight and dry matter weight of each harvested plant with plant density, respectively. Percentage dry matter was as dry matter weight divided by fresh matter weight × 100.

## RESULTS

**1. Herbage dry- and fresh-matter yields**

he annual HDMY of the plants cut at a 90-day interval was superior to the plants cut at a 60-day interval. The coefficient of variance (CV) at HDMY was the smaller in the plants cut at a 60-day interval than that at a 90-day interval (Table 1). The smaller CVs in the plants cut at a 60-day interval were partly due to a smaller value of HDMY

The annual total of herbage fresh matter yield was higher in the plants cut at a 90-day interval than at a 60-day interval. Thus, the highest herbage fresh matter yield and HDMY (117.1 t/ha and 21.3 t/ha, respectively) were obtained by cutting at a 90-day interval, and the lowest annual HDMY (about 13.4 t/ha) by cutting at a 60-day interval.

The difference in annual HDMY was smaller in the plants cut at a 60-day interval than at a 90-day interval, which was due to the reduced difference in HDMY in the aftermath, although regrowth was quite poor under both 60-day and 90-day cutting intervals.

The plants cut at a 90-day interval had the highest HDMY, mainly due to the highest HDMY at the first cutting.

2. **Percentage dry matter**

The percentage dry matter was higher in the plants cut at a 90-day interval than at a 60-day interval. There was a significantly positive correlation between the percentage dry matter and its CV ($r = 0.714$, $P<0.05$). However, the differences in percentage dry matter between the plants cut at 90- and 60-day intervals were small, which had a high percentage dry matter due to the leaf drying after the frost damage (Table 2).

Table 1. Effect of variants on annual herbage dry matter yield (HDMY) and coefficient of variance (CV) in HDMY.

| Variants | Cutting interval[1)] | |
|---|---|---|
| | 90-day interval | 60-day interval |
| HDMY (kg/m$^2$/yr) | 2.13 [a] | 1.34 [b] |
| | (100) | (62.9) |
| CV (%) | 28,59 | 21,38 |

1) Figures with different letters of a and b, denote the significant difference between elements of each variant at 5 % and 10 % levels, respectively.

2) Values in parentheses are percentages of HDMY to that in the maximum element.

Table 2. Effect of variants on percentage dry matter (PDM) and coefficient of variance (CV) in PDM.

| Variants | Cutting interval[1)] | |
|---|---|---|
| | 90-day interval | 60-day interval |
| PDM | 18.2 [a] | 15.1 [b] |
| | (100) | (82.9) |
| CV (%) | 25,88 | 26,86 |

1) Figures with different letters of a and b, denote the significant difference between elements of each variant at 5 % and 10 % levels, respectively.

2) Values in parentheses are percentages of PDM to that in the maximum element.

### 3. Plant characters and their relationships to herbage dry matter yield

Table 3 shows the annual means of the plant characters cut at different cutting intervals. In the plants cut at a 90-day interval, plant height, mean tiller weight, percentage dry matter, HDMY, leaf area index and crop growth rate were higher, but tiller number and percentage leaf blade were lower than in cut at a 60-day interval.

HDMY in the aftermath decreased at the second and third cutting times at both cutting intervals. Most of the tillers whose shoot apices remained as stubbles after cutting, regrew rapidly whereas the cutting at a 90-day interval possibly removed the shoot apices of many tillers. Since many new tillers appeared from the nodes below a 30-cm heigh, regrowth was less variable in the plants cut at a 30-cm height.

Table 4 shows the correlation coefficients of HDMY with each plant character and cutting interval. The HDMY positively correlated with plant height, mean tiller weight, leaf area index, crop growth rate and cutting interval, but negatively correlated with tiller number and percentage leaf blade, cut at different intervals.

Table 3. Annual mean in plant characters[1)] in Napiergrass grown by cutting at different intervals.

| Cutting interval | Cutting height | PH (cm) | TN (No./m$^2$) | MTW (g/tiller) | PLB (%) | PDM (%) | HDMY (g/m$^2$) | LAI | CGR (g/m$^2$/d) | NAR (g/m$^2$/d) |
|---|---|---|---|---|---|---|---|---|---|---|
| 90-day | 30-cm | 237 | 32 | 38,6 | 40,1 | 18,2 | 1066 | 6,9 | 10,6 | 1,6 |
| 60-day | 30-cm | 166 | 73 | 11,4 | 62,0 | 15,1 | 446 | 4,4 | 6,7 | 1,4 |

1) PH: plant height, TN: tiller number, MTW: mean tiller weight, PLB: percentage leaf blade, PDM: percentage dry matter, HDMY: herbage dry matter yield, LAI: leaf area index, CGR: crop growth rate, NAR: net assimilation rate.

Table 4. Correlation coefficients between herbage dry matter yield (HDMY) and each plant character[1)]

| PH | TN | MTW | PLB | PDM | LAI | CGR | NAR | CI |
|---|---|---|---|---|---|---|---|---|
| 0.891**[2)] | -0.729* | 0.956** | -0.878** | 0.749* | 0.852** | 0.904** | 0,476 | 0.853** |

1) CI: Cutting interval. As for PH, TN, MTW, PLB, PDM, LAI, CGR, NAR, refer to Table 3

2) **, *: Significant at 1 % and 5 % level, respectively.

### 4. Plant characters that determined herbage dry matter yield under different cutting practices

HDMY was positively correlated with plant height, mean tiller weight, leaf area index, crop growth rate and cutting interval and negatively with tiller number and percentage of leaf blade to whole harvested plant. HDMY is calculated by several ways; For example, as the product of tiller number with mean tiller weight, and the product of cutting interval with crop growth rate that is equal to the product of leaf area index with net assimilation rate. Thus, the change in HDMY was closely correlated with that in mean tiller weight, that in cutting interval and leaf area index. However, the change in net assimilation rate did not closely correlate with that in HDMY and the increase in HDMY often led to a decrease in percentage leaf blade. Since heading reduced tiller number and leaf production especially at the second and third cuttings in the plants cut at a 90-day and 60-day interval, respectively.

## CONCLUSIONS

Dry matter productivity was higher in the plants cut at a 90-day interval than in those cut at a 60-day interval in the first established year. The increases in plant height, mean tiller weight, leaf area index and crop growth rate were correlated with the increase in HDMY, and variation in annual HDMY was reduced by cutting at a 60-day interval. Thus, the highest of HDMY was attained by cutting at a 90-day interval

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